DUAL LED
“BLINKY” KIT

Ramsey Electronics Model No. BL1

Whether you’re just beginning or an “old pro” this kit will bring a smile. And if you’re not careful, you’ll learn about astable multivibrators while you’re at it! Complete instructions guide you through assembly, along with some interesting applications.

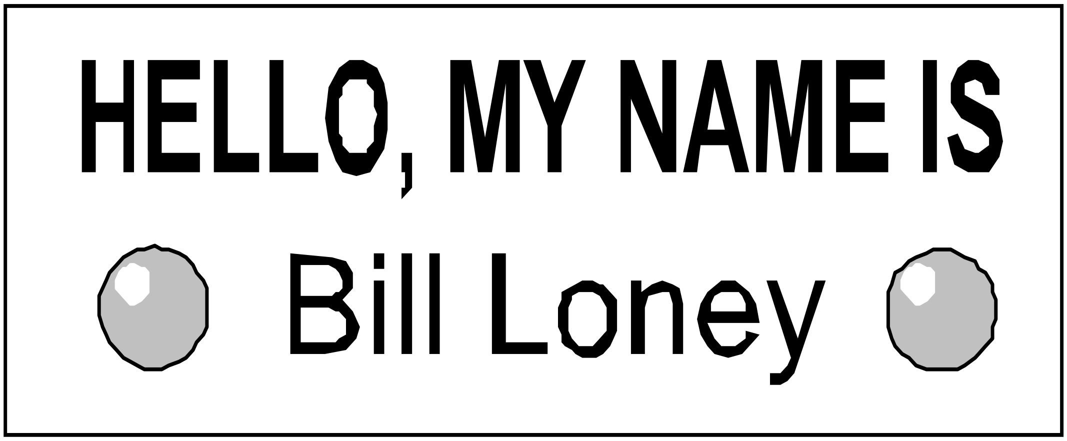
- **Winking lights are all around us! Find out what makes them “tick” and put ‘em to use for you.**
- **Hundreds of uses! Great for name badges, warning lights, model RR signals...you name it!**
- **Ideal first kit - tweak a child’s interest with this fun and easy to build kit.**
- **Runs on 5-15 VDC, uses only 20 mA.**

INTRODUCTION

Blinking lights are nothing new; from automobile turning signal indicators to stop lights to Christmas tree lights, we're all very used to them. We probably don't think much about how lights blink and flash, we just know that they do. When you stop and think about it, the only way to make a light blink is to switch it on and off quickly. For two lights, we need two switches. And to make them "blink" alternately one light must know what the other is doing.

In the past, such "automatic switches" were mechanical gadgets, using cams, relays, or even heat. A common use of this is a blinking Christmas tree bulb which has a bi-metallic strip inside. When the light is initially "turned on" this strip heats up and then moves, disconnecting the circuit. It then cools to the point where the strip moves back to its original position, reconnecting the circuit. In this way, the bulb will "oscillate" on and off as long as power is applied.

In our new age of electronics, the idea is to make such switching arrangements as simple, small, and inexpensive as possible. Your BL1 is a good example of letting transistors do the work that formerly required complicated motor driven switches, relays or thermal devices.



HOW IT WORKS

Basic Theory

The Blinky Kit (BL1) is mainly comprised of the basic electronics circuit “Astable Multivibrator” or “Free-running Multivibrator”. It is a circuit that is made up of two cross-coupled transistor switches. The design of this circuit requires one of the switches to be on and the other to be off. It will automatically alternate the on/off conduction of the switches. Q1 and Q2 act as switches turning LED1 and LED2 on and off alternately. R1 and R2 values are set to give LED1 and LED2 the proper current operation (current limiters). R3 and R4 limit current for the Base circuits of Q1 and Q2. C1 and C2 values are set to determine the blinking rate of the LED’s.

Detailed Theory of Operation

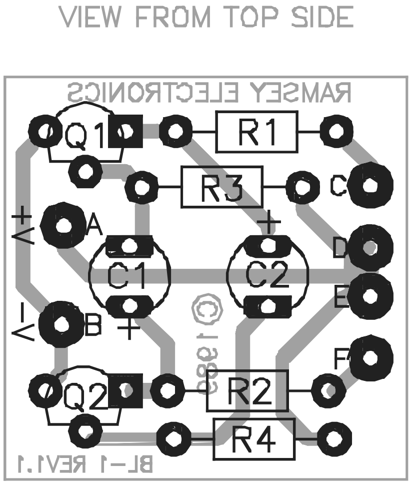
For explanation we will assume Conventional Current Flow (Positive to Negative). For Electron Flow (Negative to Positive) just reverse the direction of the Current Flow.

When the circuit is turned on, one of the two transistors will come up conducting (closed switch) and the other cutoff (open switch). This is determined by small differences in the manufacturing of the components; which one comes up first is not important. For ease of explanation let’s assume Q1 conducts first. Current flows from the Positive Terminal of the battery through LED1, R1, Q1 (Collector to Emitter), to the Negative Terminal of the battery causing LED1 to light. At the same time current flows from the Positive Terminal of the battery through R4, C2, and Q1 (Collector to Emitter) to the Negative Terminal of the battery causing C2 to charge. The Charge on C2 slowly builds a positive voltage on the Base of Q2. When this charge reaches +0.7 volts Q2 will turn on lighting LED2. At the same instant Q2’s collector voltage will drop to zero, the change will be felt through C1 to Q1’s base turning it and LED1 off. C2 with its charge path removed, will now discharge through R4, LED1, R1, to the other side of C2. This discharge current of C2 is insufficient to light LED1 due to the large resistance of R4. As C2 discharges the forward bias on Q2 will slowly decay. While Q2 conducts current flows from the Positive Terminal of the battery through LED2, R2, Q2 Collector to Emitter, to the Negative Terminal of the Battery keeping LED2 lit. We also have current flow from the Positive Terminal of the battery through R3, C1, Q2 Collector to Emitter to the Negative Terminal of the battery. This slowly charges C1 placing a growing Positive charge on the Base of Q1. When this charge reaches 0.7 volts Q1 and LED1 turn on and Q2 and LED2 turn off. The cycle repeats until the battery is disconnected or dies.

BL1 PARTS LAYOUT DIAGRAM

Your printed circuit board is very small, giving you practice with today's miniature electronics. And consider while you are building this kit that the whole circuit can be made as small as one of the LEDs that will soon be blinking!

BL1 Parts layout diagram



IMPORTANT: Connect the longer (anode) LED wires to D and E.

NOW LET’S GET STARTED !

First, check your parts against the following Kit Parts List:

BL1: PARTS SUPPLIED WITH KIT:

- ☐ 1 BL1 printed circuit board
- ☐ 2 100 ohm resistor [brown-black-brown] [R1,2]. (may also be 120 ohm [brown-red-brown])
- ☐ 2 47K ohm resistor [yellow-violet-orange] [R3,4]
- ☐ 2 Electrolytic capacitors (any value from 4.7 uf to 22uf) [C1,2]
- ☐ 2 NPN transistor (Q1) [2N3904 or equivalent] and Q2
- ☐ 2 Light Emitting Diodes (style may vary) [LED1,2]

REQUIRED, NOT SUPPLIED:

- ☐ 3 volt DC power supply (any size batteries).
- ☐ "Hookup" wire to connect batteries to BL1.
- ☐ Whatever box, badge, or other object you want to put your finished kit into.
- ☐ A power switch (if you plan to use one).

CIRCUIT BOARD ASSEMBLY

FOR EACH PART, OUR WORD "INSTALL" ALWAYS MEANS THESE STEPS:

1. Pick the CORRECT part value to start with.
2. Insert it into the CORRECT PC board location.
3. ORIENT it correctly, which means: PLEASE follow the PC board drawing and the written directions for ALL parts where there's a right way AND a wrong way to solder it in. (Diode bands, electrolytic capacitor polarity, transistor shapes, dotted or notched ends of ICs, and so forth.)
4. Push the component as close to the component side as is mechanically possible.
5. Solder ALL connections unless directed otherwise. Use enough heat and solder flow for clean, shiny, completed connections. Don't be afraid of ANY pen-style soldering iron having enough heat to damage a component.
6. Trim or "nip" excess wire lengths after soldering.
7. Check your work and check off each component as you install it.

Remember that the "component" side of the circuit board, the side shown in the parts layout diagram, is viewed from the TOP. There are NO PC traces on this side of the circuit board. The components leads will pass through the board and be soldered on the "solder" side of the board.

☐ 1. Install R1, 100 ohm [brown-black-brown] Gently bend its leads so the part won't fall out when you are soldering it.

☐ 2. Install R3, 47K ohm [yellow-violet-orange]

☐ 3. Install C1, one of the electrolytic capacitors. NOTE: An electrolytic capacitor is always "polarized"- that is it has a positive and negative terminal. It is very important that these components are installed correctly. These parts will be marked with a striped band containing a (-) or a (+) symbol. This side of the component corresponds to the lead on that side. For C1 the (-) side must be towards R1 and R3.

☐ 4. Install transistor Q1. The "flat" side of the transistor must face C1. Gently spread the wires so that all three will slide into the holes at the same time. Press the transistor down until just a little bit of wire is showing between the transistor and the circuit board.

☐ 5. You are now half done with the BL1 circuit. Check to make sure that all the parts are in the correct position, and that all of your solder connections look good. Notice that the other half is a repeat of what you just did, using the same part values. Let’s finish up!

☐ 6. Install R4, 47K ohm [yellow-violet-orange]

☐ 7. Install R2, 100 ohm [brown-black-brown]

☐ 8. Install C2, the other electrolytic. Remember to watch the polarity!

☐ 9. Install Q2, the last 2N3904 transistor. Review step 4 if necessary. Notice on the parts placement illustration that the flat side is toward the edge of the board. Now all we need to do is install the two LEDs and hook up a battery! First, if you do not have a definite plan on how you will finish or mount your BL1, it's a good idea to plan on NOT shortening the LED wires. Plan to solder the wires in place so that the LED wires can be bent later in any position you desire. Notice the four holes in a row for mounting the LEDs.

☐ 10. Install LED 1. The longer LED wires are the ANODE wires and must be connected to the two CENTER holes, with the shorter cathode wires going to the two outer holes.

☐ 11. Install LED 2.

CONGRATULATIONS!

You've just finished assembling your kit. Look it over carefully for misplaced components and bright solder connections. Watch for solder "bridges" between components.

TESTING AND OPERATION

☐ Solder a red wire to the (+) connection.
☐ Solder a black wire to the (-) connection.

The LED blinky needs at least 3 volts DC to run and can handle up to 15 volts without alteration. It should start blinking as soon as it gets 3 to15 volts correctly connected to the voltage input wires.

Remember these LEDs are designed to radiate light in the forward direction. If the light looks dim from the side, you'll be more impressed if you stare them straight in the eye.

WHAT DO WE DO WITH IT NOW ?

What you do with your blinky kit is up to you. However, the most useful characteristic of this simple circuit is that the blinking LEDs ATTRACT ATTENTION very effectively. Is there some piece of electronic equipment that you're leaving on, letting the batteries run down!? Maybe you'll remember to turn it off when not in use, if you see those blinking lights.

Mount the BL1 in a serious looking black box just inside a darkened hallway or on your dashboard and unwelcome visitors may assume an alarm system has been armed.

You can use the BL1 in conjunction with other Ramsey kits to make them more interesting. How about an "on the air" indicator for our FM wireless transmitters? Or, add it to our "Mad Blaster" noisemaker or Microwave Motion Detector for additional special effects.

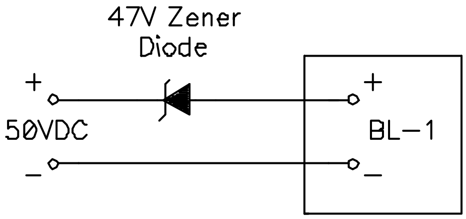
If you know how to work safely with AC power cords and switches, the BL1 can be adapted to let you know when heating devices such as soldering irons have been left on. Make an appropriate power supply circuit for the BL1.

THE BL1 AS AN INEXPENSIVE VOLTAGE INDICATOR

Since the BL1 is designed to begin flashing at 3.0VDC, and since zener diodes are rated in a wide range of precision voltages, the BL1 can be combined with a zener diode to serve as a voltage level indicator. This can be helpful for home-brew projects, adjustable power supplies or battery packs for which an exact voltage is needed.

In the sample circuit below, the BL1 will begin blinking when the input voltage is equal to the zener voltage plus 3 volts. Be aware that the power rating of the zener must be considered.

The BL1 kit draws 20ma. In this example the zener voltage is 47V, the current through the zener is 20ma. P(watts)= E*I, P= 47V*.02A =.94W so a minimum of a 1 watt zener must be used.



RAMSEY TRANSMITTER KITS
- **FM10A FM Stereo Transmitter**
- **TV6 Television Transmitter**

RAMSEY RECEIVER KITS
- **FR1 FM Broadcast Receiver**
- **AR1 Aircraft Band Receiver**
- **SR2 Shortwave Receiver**
- **AA7 Active Antenna**
- **SC1 Shortwave Converter**

RAMSEY HOBBY KITS
- **SG7 Personal Speed Radar**
- **SS70A Speech Scrambler**
- **SP1 Speakerphone**
- **MD3 Microwave Motion Detector**
- **PH14 Peak Hold Meter**
- **TG1 DTMF Tone Grabber**

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- **HR Series HF All Mode Receivers**
- **QRP Series HF CW Transmitters**
- **CW7 CW Keyer**
- **CPO3 Code Practice Oscillator**
- **QRP Power Amplifiers**

RAMSEY MINI-KITS

Many other kits are available for hobby, school, Scouts and just plain FUN. New kits are always under development. Write or call for our free Ramsey catalog.

Call or write for our full line catalog!

REQUIRED TOOLS

- Soldering Iron (WLC100)
- Thin Rosin Core Solder (RTS12)
- Needle Nose Pliers (MPP4 or RTS05)
- Small Diagonal Cutters (RTS04)

ADDITIONAL SUGGESTED ITEMS

- Helping Hands Holder for PC Board/Parts (HH3)
- Technician’s Tool Kit (TK405)
- Desoldering Braid (RTS08)

TOTAL SOLDER POINTS

75

ESTIMATED ASSEMBLY TIME

Beginner..........2.3 hrs
Intermediate....1.3 hrs
Advanced........1.0 hrs

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